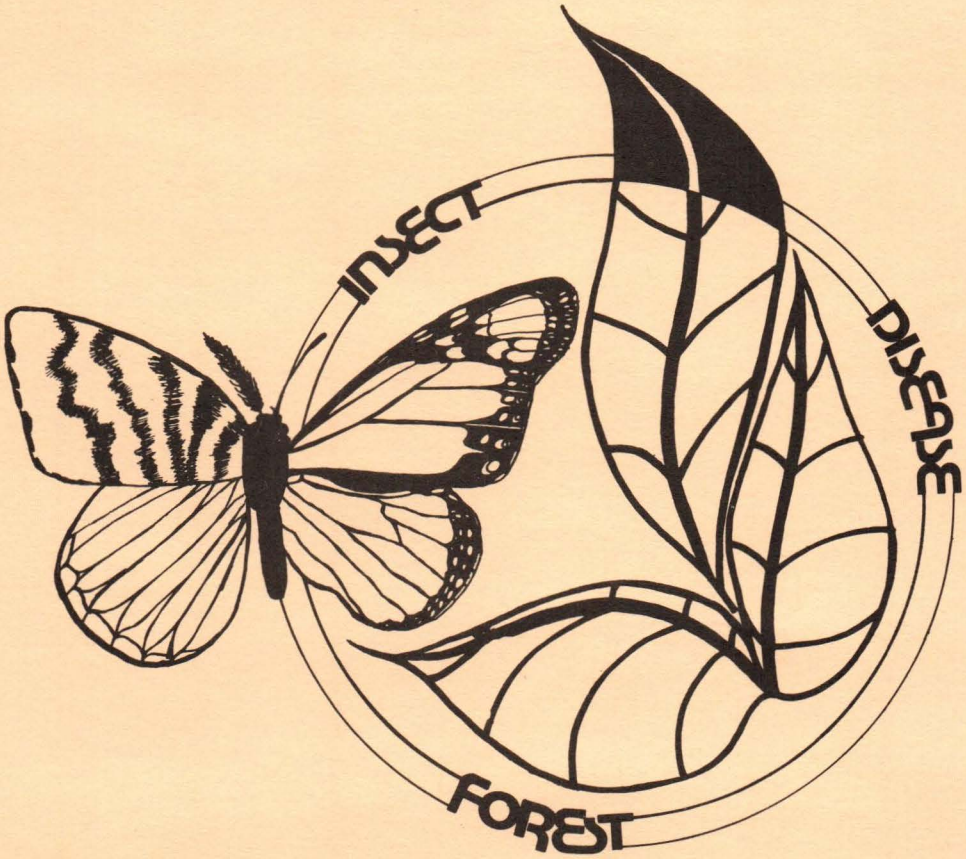
MISSOURI FOREST PEST REPORT 1983



Missouri Department of CONSERVATION

Forestry Division

MISSOURI FOREST PEST REPORT

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INSECTS OBSERVED IN 1983 - DISCUSSED IN REPORT

1. Black Turpentine Beetle, *Dendroctonus terebrans*, (Oliv.)
2. Bronze Birch Borer, *Agrilus anxius*, (Gory)
3. Carpenterworm, *Prionoxystus robiniae*, (Peck)
4. Cottonwood Borer, *Plectrodera scalator*, (F.)
5. Cottonwood Leaf Beetle, *Chrysomela scripta*, (F.)
6. Cottonwood Twig Borer, *Gypsonoma haimbachiana*,(Kft.)
7. Eastern Tent Caterpillar, *Malacosoma americanum*, (F.)
8. European Pine Sawfly, *Neodiprion sertifer*, (Geoff.)
9. Evergreen Bagworm, *Thyridopteryx ephemeraeformis*, (Haw.)
10. Fall Webworm, *Hyphantria cunae*, (Frury)
11. Gypsy Moth, *Porthetria dispar*, (L.)
12. Loblolly Pine Sawfly, *Neodiprion taedae linearis*, (Ross.)
13. Looper Complex
14. Nantucket Pine Tip Moth, *Rhyacionia frustrana*, (Comstock)
15. Pales Weevil, *Hylobius pales*, (Hbst.)
16. Pine Webworm, *Tetralopha robustella*, (Zell.)
17. Poplar Tent Maker, *Ichthyura inclusa*, (Hbn.)
18. Red Oak Borer, *Enaphalodes rufulus*, (Haldeman)
19. Red Headed Pine Sawfly, *Neodiprion leconte*, (Fitch)
20. Shingle Oak Skeletonizer
21. True Tree Grasshopper, *Dendrotettix quercus*, (Pack.)

21a. Twig pruner, *Agrilus* sp.

22. Two-lined Chestnut Borer, *Agrilus bilineatus*, (Web.)
23. Variable Oak Leaf Caterpillar, *Heterocampa manteo*, (Dbldy.)
24. Walnut caterpillar, *Datana integerrima*, (G. & P.)
25. White Pine Aphid, *Cinara strobi*, (Fitch)

INSECTS OBSERVED IN 1983 - NOT DISCUSSED IN REPORT

1. Asiatic Oak Weevil, Cyrtepistomus castaneus, (Roelofs)
2. Boxelder Bug, Leptocoris trivittatus, (Say)
3. Gall Insects
4. Holly Leaf Miner, Phytomyza ilicicola, (Loew)
5. Ips Beetle, Ips sp.
6. Monarch Butterfly, Danaus plexippus, (L.)
7. Pin Oak Sawfly, Caliroa lineata, (MacGillivary)
8. Obscure Scale, Melanaspis obscura, (Comstock)
9. Pine Needle Scale, Phenacaspis pinifoliae, (Fitch)
10. Twig Girdler, Oncideres cingulata, (Say)
11. Twig Pruner, Elaphidionoides villosus, (F.)
12. Walking Stick, Diapheromera femorata, (Say)
13. Wheel Bug, Arilus cristatus, (Linn.)
14. White Pine Bark Aphid, Pineus strobi, (Htg.)

DISEASES OBSERVED IN 1983 - DISCUSSED IN FOREST AND ORNAMENTAL TREE DISEASE SECTION

1. Actinopelte Leaf Spot of Oak, Actinopelte dryina (Sacc.) Hoehn.
2. Apple Scab, Venturia inaequalis (Cke.) Wint. ap. Thum.
3. Brown-Spot Needle Blight, Systremma acicola (Dearn) Wolf & Barbour
4. Diplodia Tip Blight, Diplodia pinea (Desm.) Kickx.
5. Dothistroma Needle Blight, Dothistroma pini Hulbarry
6. Kabatina Blight, Kabatina juniperi Schneider & Arx
7. Sycamore Anthracnose, Gnomonia platani Edg.

OTHER DISEASES OBSERVED IN 1983

1. Ash Anthracnose, Gloeosporium aridum Ell. & Holw.
2. Ash Decline, unknown
3. Armillaria Root Rot, Armillariella mellea (Vahl. ex Fr.) Karst.
4. Bacterial Wetwood of Elm, Erwinia nimipressuralis (Burr.) Winsl.
5. Black Knot of Plum and Cherry, Dibotryon morbosum (Schw.) Th. & Syd.
6. Bleeding Canker, Phytophthora cactorum (Leb. & Cohn) Schr.
7. Botryodiplodia Canker of Oak, Botryodiplodia ravenelii Sacc.
8. Botrytis Blight, Botrytis cinerea Pers. ex Fr.
9. Butternut Decline, Sirococcus clavigignenti-juglandacearum sp. nov.
10. Cedar-Apple Rust, Gymnosporangium juniperi-virginianae Schw.
11. Cedar-Hawthorn Rust, Gymnosporangium globosum Farl.
12. Coryneum Twig Blight of Oak, Coryneum sp.
13. Cytospora Canker of Willow - Cytospora chrysosperma (Pers.) F.
14. Cytospora Canker of Blue Spruce - Cytospora kunzei Sacc.
15. Drought Damage, weather

16. Dutch Elm Disease, Ceratocystis ulmi (Buism.) C. Moreau
17. Eastern Gall Rust, Cronartium quercum (Berk.) Miyabe ex Shirai f. sp. echinatae
18. Elm Phloem Necrosis, mycoplasma-like-object
19. Fireblight, Erwinia amylovora (Burr.) Winsl.
20. Fusarium Canker of Walnut, Fusarium sp.
21. Heat Scorch, weather
22. Hypoxylon Canker of Oak, Hypoxylon atropunctatum (Schw. ex Fr.) cke.
23. Maple Anthracnose, Gloeosporium apocryptum E.& E.
24. Maple Canker, Steganosporium sp.
25. Maple Decline, unknown
26. Mimosa Wilt, Fusarium oxysporum (Schl.) em Snyd. & Hams.
27. Monochaetia Leaf Spot, Monochaetia desmazierii Sacc.
28. Naemacyclus Needlecast, Naemacyclus minor Butin
29. Nectria Target Canker, Nectria galligena Bres.
30. Needle Tip Burn of Eastern White Pine, air pollution
31. Oak Anthracnose, Gnomonia quercina Kleb.
32. Oak Leaf Blister, Taphrina caerulescens (Mont. & Desm.) Tul.
33. Oak Wilt, Ceratocystis fagacearum (Bretz) Hunt
34. Pestalotia Needle Blight of Pine, Pestalotia sp.
35. Phomopsis Blight, Phomopsis juniperovora Hahn
36. Pine Needle Rust, Coleosporium asterum (Diet.) Syd.
37. Pine Wilt Disease, Bursaphelenchus xylophilus (Steiner and Buhrer) Nickle
38. Rhizosphaera Needlecast, Rhizosphaera kalkhoffii Bub.
39. Sapsucker injury, yellow-bellied sapsucker
40. Squirrel Injury, squirrel
41. Tar Spot of Maple, Rhytisma acerinum Pers. ex Fr.
42. Thyronectria Canker, Thyronectria austro-americana (Speg.) Seeler

43. Verticillium Wilt, Verticillium dahliae Kleb.

44. Walnut Anthracnose, Gnomonia quercina Kleb.

45. Winter Burn & Winter Drying, weather

FORESTRY DISTRICTS

BOOTHEEL FOREST DISTRICT
Box 631 (116 S. Eighth St.)
Poplar Bluff, MO 63901
314/785-2846

CLEARWATER FOREST DISTRICT
Star Route, Box #2 (Hwy. 34)
Piedmont, MO 63957
314/223-4525

CLINTON FOREST DISTRICT
Box 147 (Old Highway 13 So.)
Clinton, MO 64735
816/885-5633

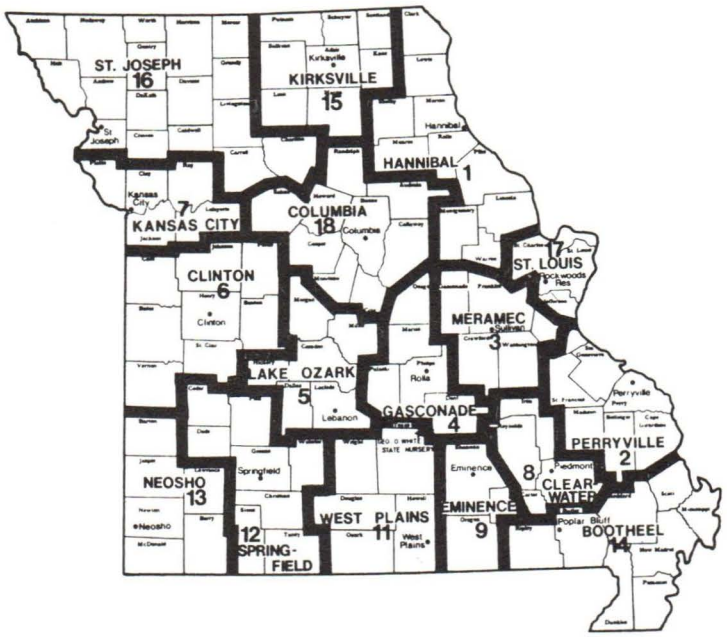
COLUMBIA FOREST DISTRICT
1512 Bus. Loop 70 West,
Suite A
Columbia, MO 65201
314/443-7151

EMINENCE FOREST DISTRICT
Box "G" (Hwy. 19 North)
Eminence, MO 65466
314/226-3616

GASCONADE FOREST DISTRICT
Box 509 (Jct. E & Y)
Rolla, MO 65401
314/364-4221

HANNIBAL FOREST DISTRICT
Box 324
(Tower Plaza, 655 Clinic Rd.)
Hannibal, MO 63401
314/221-4805

KANSAS CITY FOREST DISTRICT
Rt. #2, Box 295 (R. D. Mize Rd.)
Blue Springs, MO 64015
816/228-3766



KIRKSVILLE FOREST DISTRICT
Box 291 (1201 N. Osteopathy)
Kirksville, MO 63501
816/665-4651

LAKE OZARK FOREST DISTRICT
Box 911 (Hwy. 5 South)
Lebanon, MO 65536
417/532-7612

MERAMEC FOREST DISTRICT
Box 248
(Jct. Bus. I-44 & 185 South)
Sullivan, MO 63080
314/468-4157

NEOSHO FOREST DISTRICT
Box 157 (Bus. 71 South)
Neosho, MO 64850
417/451-4158

PERRYVILLE FOREST DISTRICT
Box 152 (West Hwy. T)
Perryville, MO 63775
314/547-4537

SPRINGFIELD FOREST DISTRICT
1675 East Seminole, Suite 100
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417/881-5102

ST. JOSEPH FOREST DISTRICT
3408 Ashland
St. Joseph, MO 64506
816/233-3212

ST. LOUIS FOREST DISTRICT
Route 1, Box 1599
Rockwoods Reservation)
Glencoe, MO 63038
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WEST PLAINS FOREST DISTRICT
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West Plains, MO 65775
417/256-7161

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Jefferson City, MO 65102
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MISSOURI FOREST PEST REPORT

Forestry Division

INTRODUCTION

Since we have been writing this report over the past twenty-one years, we have had weather extremes from the low to the high end of the scale. Some years have been extremely dry, but a few have been wet.

Drought has significantly had an impact upon our hardwood forests. Each tree species was stressed to different degrees and responded accordingly.

Although 1983 rainfall was average, the timing was poor as concerns moisture available to plants during June through October. Although trees are able to adapt to moisture fluctuations, if moisture is not available in adequate amounts during the active growing season, trees are greatly stressed and may die. Site plays a big factor in determining how well a tree is able to survive under varying degrees of soil moisture. Stress can be induced if the soil is too dry or too wet. These factors, among others, are considered when attempting to diagnose tree problems.

We have experienced years with numerous insect and disease problems and others with just the normal occurrence. The variable oak leaf caterpillar appeared in 1969 and then in 1953, and finally in the 1960's became less conspicuous.

Those involved with servicing pest requests within the Department in 1983 were very busy. The drought, and numerous insect and disease occurrences created problems for forest owners, foresters, Christmas tree owners, and anyone involved with growing trees. This was not a normal year. Spring was late, summer was very dry and hot, and fall was late. Temperatures were generally warm into November and we saw very little of the monarch butterfly migration or movement of "woolly worms" on the state's highways.

The gypsy moth has made greater inroads in states north and east of Missouri. We fared well again in 1983. Although the moth is well entrenched in Pennsylvania, it is still being spread to other distant states by human activity.

The drought in Missouri in 1980 was topped by another during 1983. This year's drought caused tree stress and mortality. Once again the black and scarlet oak suffered the greatest in south central Missouri. Trees will die in 1983, but many will die within the next several years because of imposed stress and associated disease and insect problems. Factors such as drought, the two-lined chestnut borer, canker diseases, and root rot are responsible for tree mortality. Where feasible, these dead trees will be harvested for fuelwood or sawlogs.

This report includes pests that have caused damage to urban and forest trees during 1983. Some of the insects or diseases reduce the ornamental value of trees, while others cause log and lumber degrade and timber loss.

Inquiries to our Forest District offices and Forest Pest Management group become more numerous each year. We serviced a great variety of inquiries involving insect and disease identification.

Some insect populations were not as high in 1982 as in previous years. In 1983, we saw new insect and disease problems; some in fact that we haven't seen for thirty years. The 1983 drought produced stress on all of our trees and shrubs. This in turn generated many telephone calls from the public inquiring about their tree problems.

Many disease problems developed during spring and early June of 1983 due to scattered frequent rainfall and humidity. During this period conditions were ideal for the development and spread of fungi which parasitize leaves and stems. Various tree diseases continued to crop up during the entire growing season.

THE PROGRAM

In 1962, a cooperative program, the Forest Pest Control Program, was entered into with the U.S. Forest Service by the Forestry Division, Missouri Department of Conservation. Under the original agreement, the effort is designed to detect, evaluate, and control forest insects and diseases on state and private land. Department Foresters and other personnel report occurrences of damaging insects and diseases. Forest Pest Management specialists coordinate the program.

Drought, diseases, and insects can cause damage to trees and shrubs which may go unnoticed until mortality occurs. Tree losses occur on an annual basis in the forest from root, canker, and stem disease, hardwood borers, pine cambial feeders, defoliating insects, and drought.

Trees under stress are vulnerable to attack by a host of canker fungi, root rot fungi, and insect borers. Some factors which stress trees are drought, compacted soil, root disturbance, lightning strike, lack of nutrients, and wet or dry soil conditions to list just a few. Maintaining tree vigor is the most important consideration to insuring a long life.

CONDITIONS IN BRIEF

The 1983 drought had a greater impact on tree vigor and survival than any other factor. It rained normally until the end of June and then turned dry until October. Since October, 1983, rainfall amounts have been normal or above normal. Walnut production was moderate in scattered locations and acorn production was none to low in most areas.

Sycamore anthracnose, apple scab, fire blight, Kabatina blight, Diplodia tip blight and Dothistroma needle blight were especially important problems in 1983. In the spring of the year, Labatina blight emerged as a new problem of juniper in Missouri. In 1983, Dothistroma needle blight was a problem of Austrian pine for the first time in central Missouri.

The Nantucket pine tip moth made a substantial comeback in 1983. The mild winter of 1982-83 might have been responsible for successful overwintering of the pupae. A shingle oak skeletonizer infested that species in central and west Missouri, causing concern from the public. The bronze birch borer continued to kill white birch trees over the state.

All pests in this report have been observed by our Department Foresters, other Department personnel, Ramon D. Gass, Forest Entomolgoist, and Dr. Patricia E. Gowen, Forest Pathologist.

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FOREST INSECTS

Gypsy Moth - During June, July, and August, 1983, eleven male moths were recovered from traps in west and north St. Louis County. Personnel of the State Department of Agriculture in cooperation with the U.S.D.A., A.P.H.I.S., located and monitored over 5,400 traps. Other cooperators were the National Campers and Hikers Association, Department of Natural Resources, Parks and Historic Preservation Division, the University of Missouri, Entomology Department, and John Grinstead at Fort Leonard Wood.

Shingle Oak Skeletonizer - This moth was specific to shingle oak leaves on trees in central and western Missouri. Larvae fed on underneath surfaces of leaves giving tree crowns a brown appearance in July.

Nantucket Pine Tip Moth - infestation of shortleaf pine saplings, Mugho and Scotch pine was heavy this year.

Eastern Tent Caterpillar - populations collapsed in spring of 1983.

European Pine Sawfly - populations were moderate to heavy on Scotch and Mugho pines in St. Louis, Kansas City, and certain Christmas tree plantations around the state.

Loblolly Pine Sawfly - populations increased to noticeable levels in south central and southwest Missouri on shortleaf pine in 1983.

A Twig Pruner - developed on pin oak in late summer. Small clumps of leaves at the ends of many branches turned brown. The tiny Agrilus larvae tunnelled in the recent years growth which killed the tips.

Two-Lined Chestnut Borer - developed in dying black and scarlet oak as a result of drought stress.

Fall Webworm - was light to moderate over most of Missouri in 1983, but heavy in scattered locations in southwest Missouri.

* * * *

FOREST DISEASES

Actinopelte Leaf Spot - was severe on several oak species in southeast Missouri including white oak, pin oak, Northern red oak, black oak, and cherrybark oak.

Apple Scab - was widespread and severe on apple and crabapple.

Brown-Spot Needle Blight - was widespread and moderately severe on Scotch pine in Christmas tree plantations.

Coryneum Twig Blight - was slightly to moderately damaging to some black, white and post oak.

Diplodia Tip Blight - was widespread and severe on ornamental Austrian pine more than 30 years old. Some large Scotch pine were also affected.

Dothistroma Needle Blight - was slightly to moderately damaging to Austrian pine in central Missouri.

Drought Damage - numerous species statewide were severely damaged or killed by extremely hot and dry summer weather.

Dutch Elm Disease - was widespread and moderately damaging to American elm.

Fusarium Canker - was severely damaging to some 10-15 year old black walnut trees in northwest and southeast Missouri.

Heat Scorch - many species statewide exhibited scorch as a result of prolonged hot and dry summer weather.

Kabatina Blight - a new disease in Missouri, Kabatina blight was widespread and slightly to moderately damaging to Eastern red cedar and some common juniper.

Maple Canker - caused a twig dieback on some ornamental sugar maple.

Mimosa Wilt - caused mortality of some ornamental mimosa in southeast Missouri. This is a new disease in Missouri.

Oak Wilt - was a widespread problem of oak. Most damage was done to individual, ornamental oaks.

Pine Wilt Disease - caused mortality of some Scotch pine around the state.

Premature Needle Shed of Spruce - occurred statewide and was often mistakenly identified as Rhizosphaera needlecast. Norway, white, and blue spruce statewide exhibited browning and premature needle shedding due to spider mite feeding and drought injury.

Rhizosphaera Needlecast - was reported as a problem of some ornamental blue spruce.

Squirrel Injury - squirrels debarked main trunks and limbs of a number of pin oak and hackberry in Jackson and Buchanan counties.

Sapsucker Injury - was a widespread and severe problem statewide of numerous species. A number of Scotch pine were killed outright by girdling associated with feeding activity.

Sycamore Anthracnose - was statewide and severely damaging to American sycamore.

* * * *

PROJECTS

The cooperative team effort of Department Foresters and Forestry Division staff specialists resulted in a well-coordinated, successful Forest Pest Management Program again during 1983. Over 2,000 forest and shade tree requests were serviced statewide in 1983. Staff specialists were available to all who sought their assistance. In May and June and September, seven regional Pest Management sessions were held for all Department Foresters and personnel from other forestry related agencies. The meetings in St. Louis, Kansas City, and St. Joseph were designed for arborists but were also attended by Department Foresters. Over 200 people attended these one-day meetings. Department Foresters and staff specialists serviced over 1,500 pest related telephone calls. Over 1,000 diagnoses were made for the state. No serious pest problems were found during visits to the George O. White State Forest Nursery.

Gass and Gowen conducted detection and evaluation surveys on the major insect and disease problems in 1983 on 5,000,000 acres. Reports were prepared and submitted to the U.S. Forest Service.

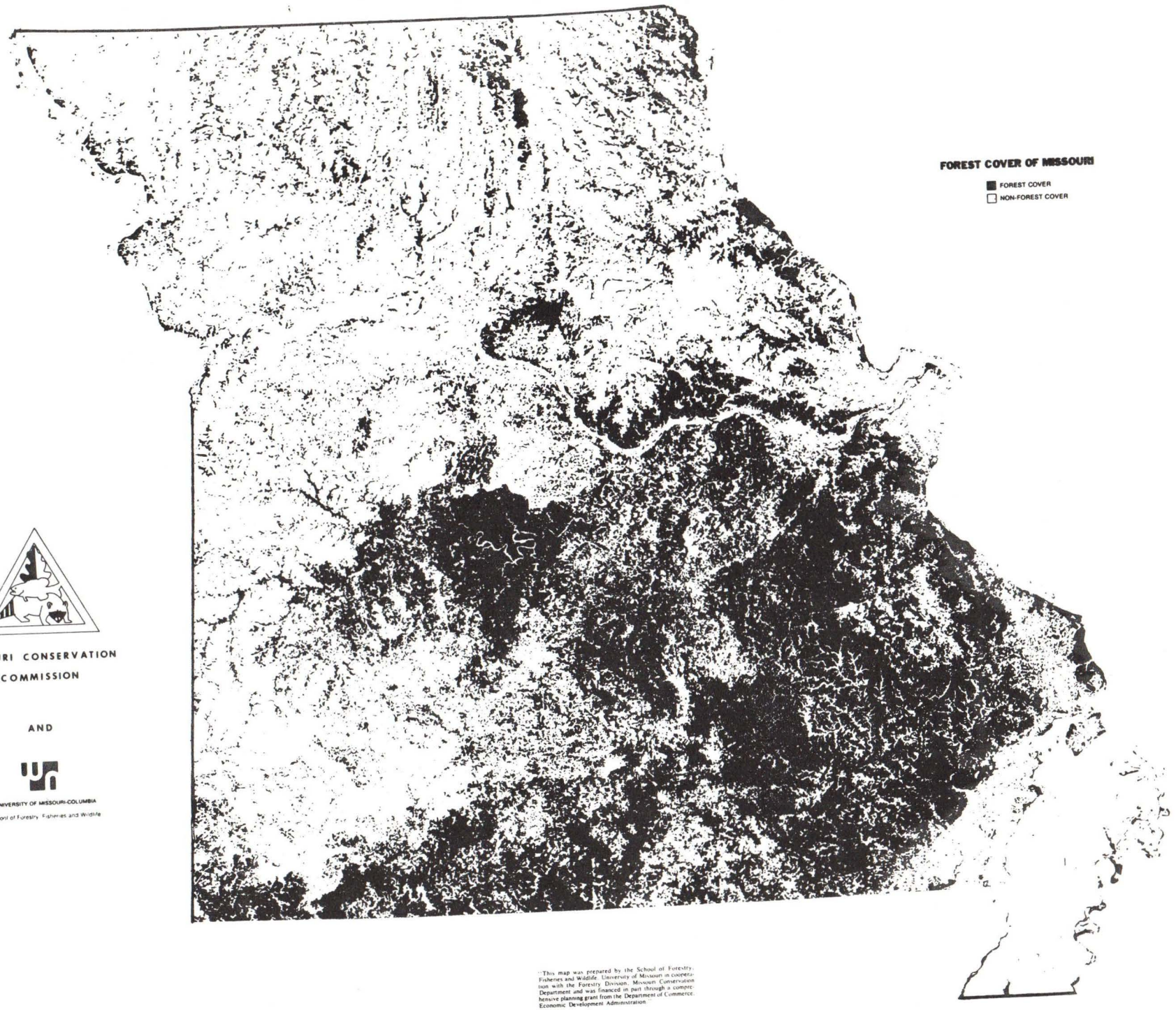
A total of five Forest Insect and Disease Status Reports (April through August) were prepared and sent to all Missouri Christmas Tree Producers, most Department personnel, and other individuals involved in tree care, totaling 900 copies per month.

Gass and Gowen attended the Annual State Cooperators Meeting hosted by the U.S. Forest Service in St. Paul, Minnesota. Gowen attended the 1983 Annual Meeting of the American Phytopathological Society in Ames, Iowa, and the North American Mycological Association Foray in Colorado.

Additional planning was conducted during 1983 to determine committee needs and personnel to compose the Gypsy Moth Coordinating Committee which was created in

1982. The purpose of this committee is to promote transfer of gypsy moth information between agencies and serve as a nucleus for an Advisory Council some day in the future.

Forest Pest Management specialists and District Foresters presented technical sessions to arborist groups and Missouri Park and Recreation workshops in various regions of the state.



MISSOURI CONSERVATION COMMISSION

AND

UNIVERSITY OF MISSOURI-COLUMBIA
School of Forestry, Fisheries and Wildlife

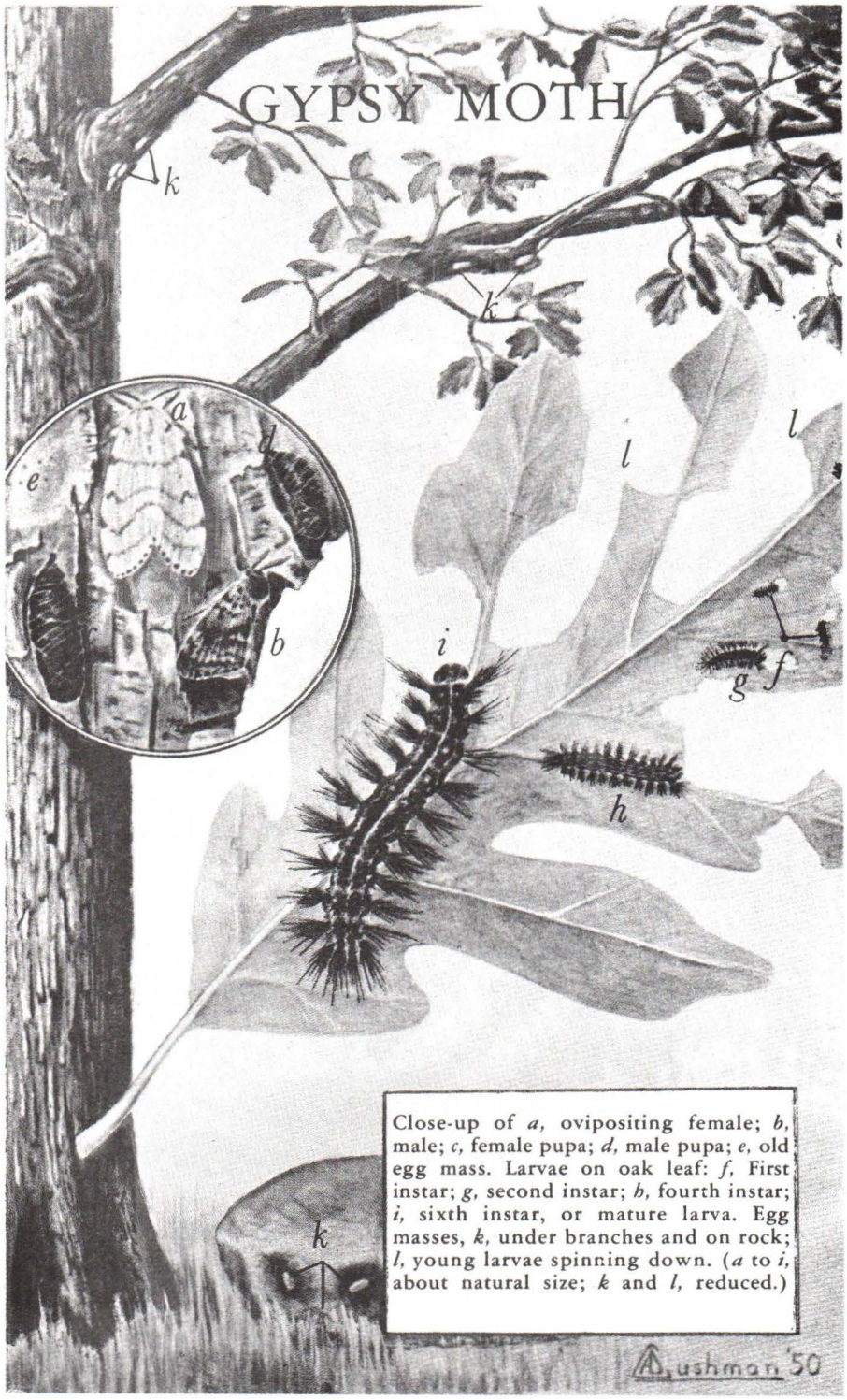
"This map was prepared by the School of Forestry, Fisheries and Wildlife, University of Missouri in cooperation with the Forestry Division, Missouri Conservation Department and was financed in part through a comprehensive planning grant from the Department of Commerce, Economic Development Administration."

HARDWOOD DEFOLIATORS AND BORERS

Gypsy Moth - During the summer of 1983, the gypsy moth defoliated slightly over 2.5 million acres in the northeast. Spot infestations developed in the Midwest and the West Coast states, as well as in West Virginia, Virginia, and North Carolina. Personnel of the Missouri State Department of Agriculture located eleven male moths in the St. Louis County area. To date, no spot infestations have been discovered in Missouri. In 1983, 5,400 gypsy moth traps were located and monitored by personnel of the State Department of Agriculture in cooperation with the U.S.D.A., Animal, Plant Health Inspection Service. Other agencies or organizations cooperating in trapping were the Department of Natural Resources, National Campers and Hikers Association, the Corps of Engineers, and John Grinstead at Fort Leonard Wood. No moths were trapped in the Hardy, Arkansas infestation which was treated in 1982.

The gypsy moth is not native to the United States, however, its life cycle does parallel that of a number of other native insects. In spring and early summer, larvae feed on a great variety of hardwood foliage causing tree mortality. With three repeated defoliations, tree mortality can occur. One defoliation can kill evergreen trees.

The gypsy moth overwinters in the egg stage in masses on bark, rocks, litter, or man-made objects.


GYPSY MOTH
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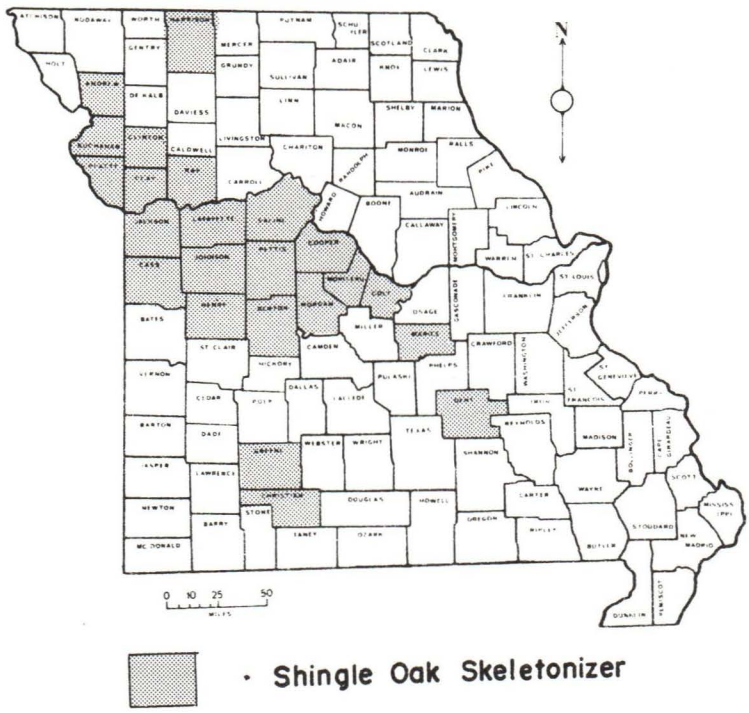
Close-up of a, ovipositing female; b, male; c, female pupa; d, male pupa; e, old egg mass. Larvae on oak leaf: f, First instar; g, second instar; h, fourth instar; i, sixth instar, or mature larva. Egg masses, k, under branches and on rock; l, young larvae spinning down. (a to i, about natural size; k and l, reduced.)
A. Bushman '50

Shingle Oak Skeletonizer - By the middle of July many shingle oak trees were skeletonized by a tiny moth larva. The major area of damage was in central Missouri west to Kansas City covering probably a total area of four million acres. Larvae skeletonized the underneath side of the leaves giving the infested tree a beige brown color in mid-July.

A similar infestation occurred in Missouri on shingle oak in 1952. Damage to shingle oak this year was unsightly, but no mortality is expected.

Trend - we expected very little, if any, reoccurrence of the shingle oak skeletonizer in 1984.

Suppression - most infested trees are growing under natural conditions and no suppression work was conducted.



The Looper Complex - In 1983 we saw very little of the looper complex. It was a problem in 1981, but collapsed in 1982. This is a group of spring defoliating insects that feed on a great variety of hardwood tree species. These insects create problems for homeowners in defoliating their favorite shade trees. The Linden looper, elm spanworm, spring cankerworm, oak leaf tiers, and oak leaf roller are the major insects composing this group.

In 1982, populations collapsed due to predation by the Calosoma beetle, virus infections and other factors in the 1981 populations.

Trend - populations should be very low for 1984, but possibly begin building for the next year, 1985.

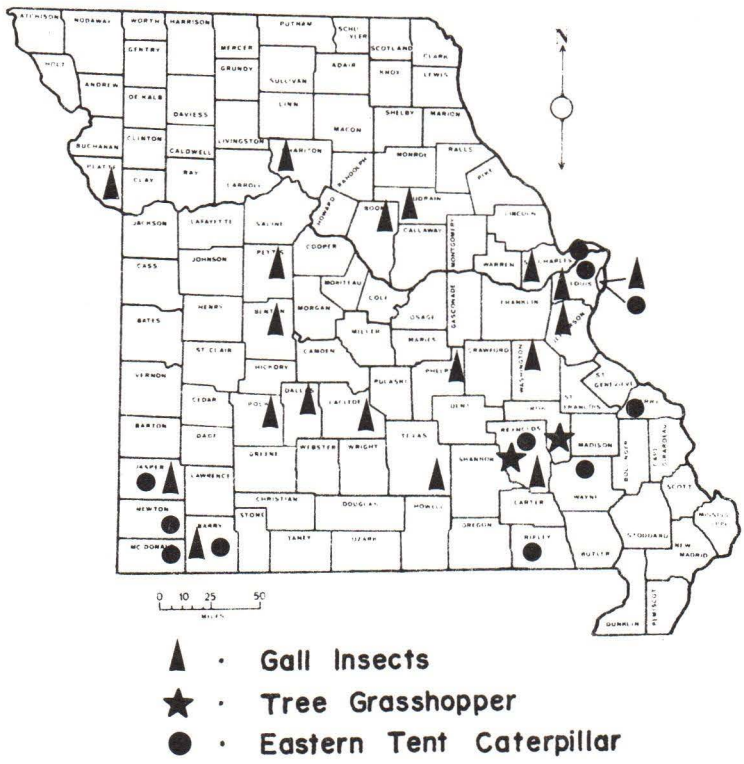
Suppression - no control was necessary.

* * * * * * * * * *

Eastern Tent Caterpillar - populations were very low during spring of 1983, probably owing to heavy spring rains and a slow foliation of eastern black cherry and other Prunus species.

Trend - populations will probably be light to moderate during spring of 1984.

Suppression - no suppression work was necessary.



Fall Webworm - populations were light to moderate in south Missouri, but heavy in scattered locations in southwest Missouri. Where the insect was present, it infested black walnut, hickory, red bud, sycamore and several other species.

Trend - populations probably will be moderate during 1984.

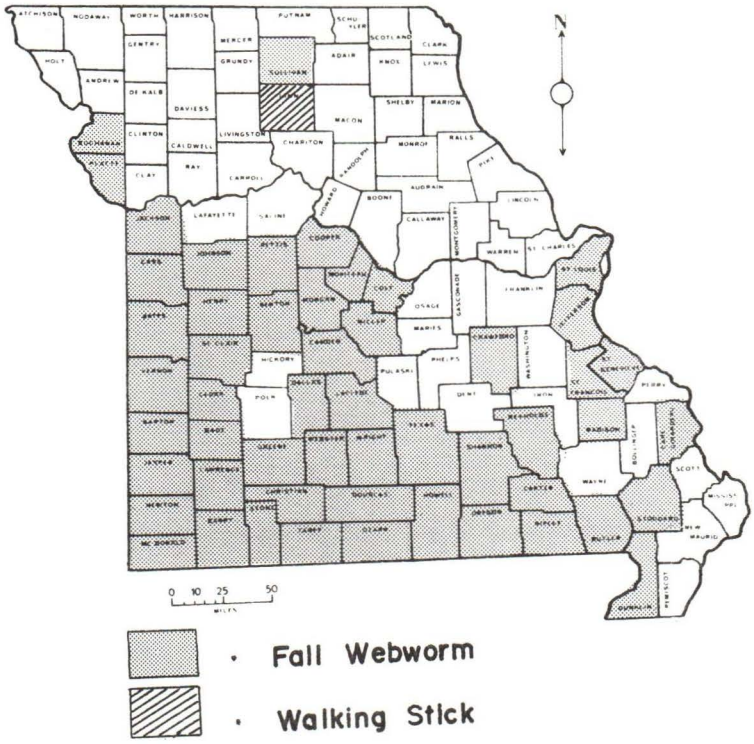
Suppression - walnut orchardists and certain shade tree owners either used an insecticide to control feeding and webbing, or individually destroyed webs.

* * * * * * * * * * *

Walnut Caterpillar - populations were light and scattered over the state. Leaf feeding usually begins in July and ends in September on black walnut and hickory. Other Datana species fed on the red oaks, post oak and smooth sumac.

Trend - populations will probably be low to moderate in 1984.

Suppression - a number of nut growers sprayed their trees to prevent infestations with approved insecticides.



True Tree Grasshopper - this tree leaf feeding grasshopper caused light to moderate defoliation again this year in Iron and Reynolds Counties. Its preferred hosts are white oak, red oak, hickory and flowering dogwood. Feeding produces a lacy appearance to infested foliage. It is a forest insect and suppression was not necessary.

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HARDWOOD BORERS

Two-Lined Chestnut Borer - although this insect is a secondary attacker of stressed black and scarlet oak, it does play a role along with root rots and Hypoxylon canker in finally killing these trees. This complex occurrence is discussed in the drought section of this report. Beginning in 1978, and through 1980, moisture was a limiting factor to tree growth which triggered attacks by the two-lined chestnut borer. Then in 1983, drought conditions prevailed from late June through September over most of the state. As a result of this drought, many more oaks and shortleaf pine trees were lost. Other tree stressing factors are late frosts, poor sites, and spring defoliating insects.

Trend - because of the droughty characteristics of Ozark soil, whenever precipitation is low during the summer growing season, trees will be stressed. The two-lined chestnut borer along with disease fungi will continue to kill these stressed trees. Tree mortality will be great in the next several years as a result of the 1983 drought.

Suppression - forest managers should recognize drought hazard sites. These areas should be managed specially, paying attention to species composition and options to even aged management and conversion to shortleaf pine where hardwood basal area is too low. On these marginal sites the entomological and pathological rotation should be used rather than a standard age rotation.

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Bronze Birch Borer - white birches over the state continued dying as a result of drought stress and infestation by the bronze birch borer. It is very likely that root rots develop on weakened white birch trees. This insect, like its counterpart, the two-lined chestnut borer, tends to be a secondary attacker and will attack trees in a weakened,declining condition. The larvae develop and feed between the bark and wood, girdling the tree, thus killing it. As dry conditions prevail, white birch will continue to die.

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The Carpenterworm and Red Oak Borer - and other living tree hardwood borers as part of our endemic, indigenous borer populations, continue to infest hardwood trees in forested areas of the state. Hardwood borers are a major problem on many hardwood trees in the urban scene.

Trend - borer infestation will continue in hardwood trees occupying poorer sites. Estimated dollar loss to the hardwood borer complex amounts to $1,500,000 annually through lumber degrade and ornamental tree loss.

Suppression - selection tree harvest, sanitation harvest and stand conversion was conducted in timber sales over the state. Some shade tree owners controlled borer infestations on high value trees.

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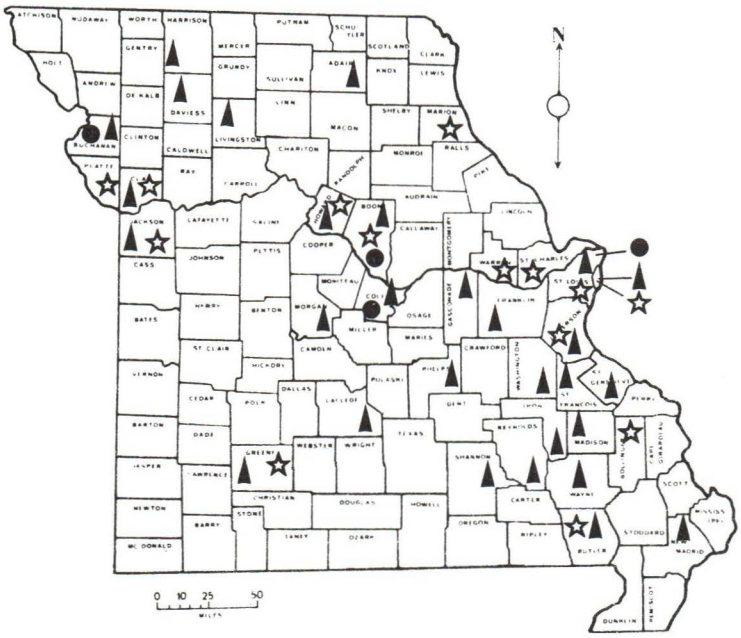
The Cottonwood Twig Borer, Cottonwood Borer, Cottonwood Leaf Beetle, and Poplar Tent Maker - these insects continue to infest cottonwood where it grows. Borer damage is greater on trees growing on poor sites. Defoliation by the Poplar Tent Maker occurs almost everywhere cottonwood grows.

Trend - no increase in infestation is anticipated in 1984.

Suppression - no control was conducted for any of these insects in 1983. If populations build, recommended controls will be used.



PINE AND CEDAR TRUNK BORERS, TWIG BORERS AND DEFOLIATORS

Nantucket Pine Tip Moth - populations over the state were very heavy during 1983. Infestation was heavy on native pine saplings within the natural range of shortleaf pine. Other species affected were Scotch pine and Mugho pine. Christmas tree producers conducted spraying to reduce second and third generations of the tip moth.

Trend - unless we experience a hard winter during 1983-1984, populations will be heavy again during 1984.

Suppression - several Christmas tree producers sprayed infested trees with a number of different insecticides.

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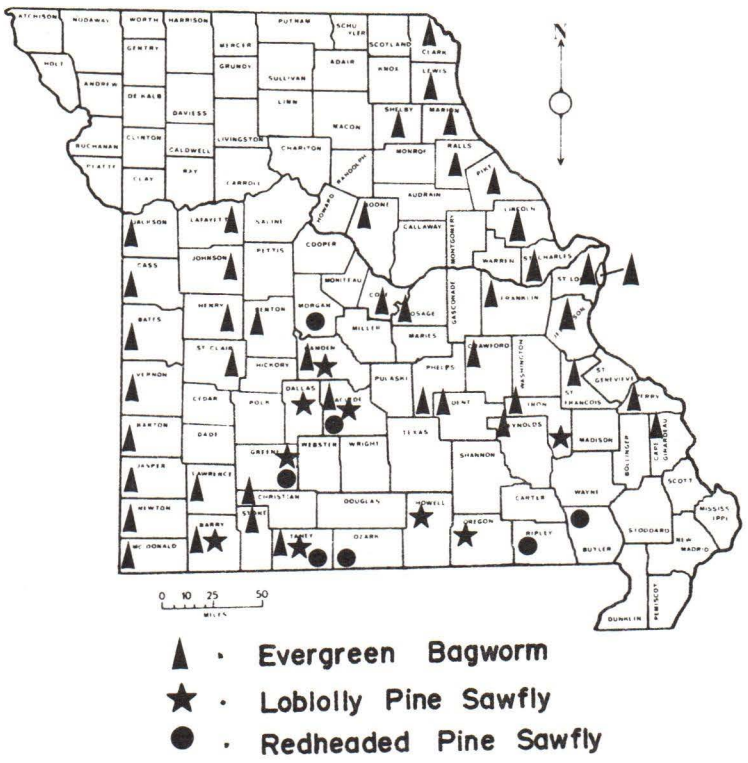
Loblolly Pine Sawfly - populations were heavy on shortleaf pine in the Cassville area in southwest Missouri. On many large planted pines defoliation was moderate to heavy. The sawfly was also reported from several counties around the Lake of the Ozarks.

Trend - we anticipate heavier populations in a larger area during the early summer of 1984.

Suppression - several owners sprayed their lawn trees with an approved insect stomach poison to control feeding.



White Pine Bark Aphid - populations were lower than in 1982. Colonies did infest scattered white pine over the state, but seldom was control required.

Trend - in 1984 populations will be light to moderate.

Suppression - very little control was required during 1983.

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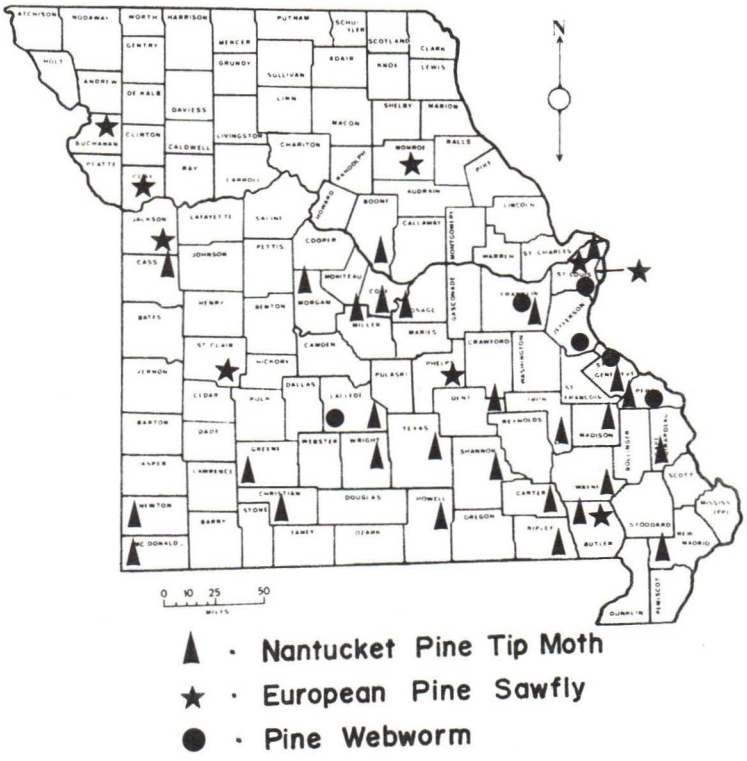
European Pine Sawfly - in St. Louis and Kansas City heavy populations were very noticeable. On some Scotch and Mugho pines defoliation was heavy.

Trend - populations should be moderate to heavy again in 1984.

Suppression - several ornamental tree owners and Christmas tree producers sprayed for control of this defoliator.



Pine Webworm - infestation was moderate to heavy on one and two-year old Scotch pine and shortleaf pine seedlings. Larvae feed on needles and produce a mud-like case around the main stem. This activity stresses and retards the growth of the seedling. Reports of infestation were from Franklin, Jefferson, Ste. Genevieve and Perry Counties.

Trend - populations will be moderate again in 1984.

Suppression - only a few growers sprayed to control this defoliating insect.

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Pales Weevil - was not a serious problem in Christmas tree plantations in 1983. We received no reports of occurrence from any of our growers this year.

Trend - infestation and damage should be very light in 1984.

Suppression - none was required this year.

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Evergreen Bagworm - infestations of the bagworm were heavy on eastern red cedar and upright pfitzer junipers. The hot, dry summer stressed ornamentals and wild native cedar predisposing them to infestation by the bagworm. Very seldom is defoliation complete, but it causes tree decline and an unsightly appearance.

Trend - populations are expected to continue to be moderate to heavy in 1984.

Suppression - many ornamental tree and shrub owners are on a maintenance spray schedule with local tree service companies and have their plants sprayed.

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Black Turpentine Beetle - light infestation was reported on shortleaf pine from Wayne, Iron and Texas Counties. Usually the Ips beetle is attracted to pine stressed by infestation of the black turpentine beetle or drought. Ips is a secondary attacker and was reported from Ripley, Reynolds, and St. Louis Counties.

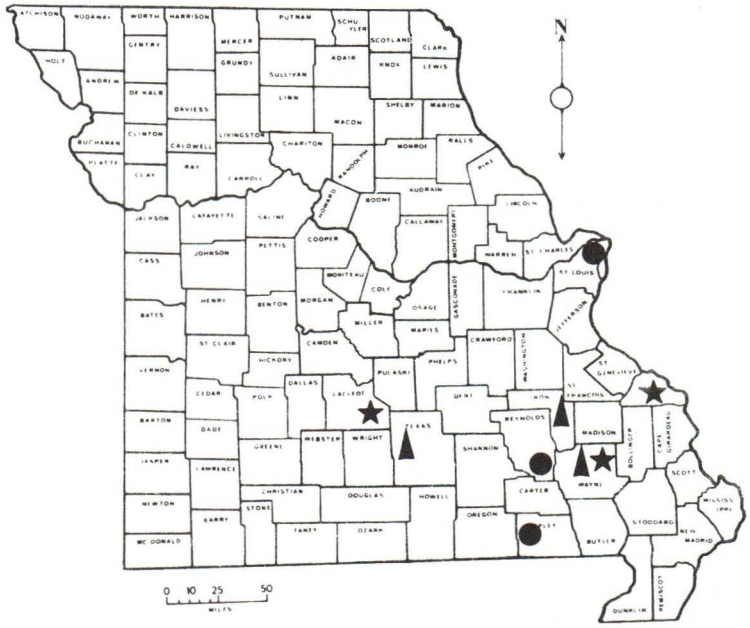
Trend - populations will exist where pine trees are distrubed in timber sales and where trees are lightning struck.

Suppression - salvage of infested trees is conducted as timber sales progress.

Redheaded Pine Sawfly - this sawfly was reported from Ripley, Butler, Taney, Greene, Laclede, and Morgan Counties. It is a defoliator of shortleaf pine of sapling size. Infestation was light to moderate in most cases.

Trend - populations will build slightly in 1984. This insect feeds longer than either the European pine sawfly or loblolly pine sawfly.

Suppression - spraying was conducted in various plantings for this insect.

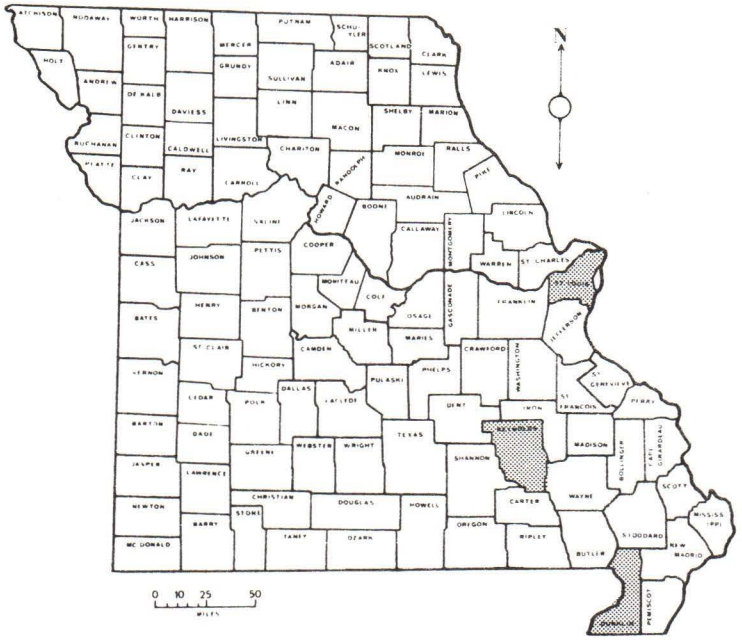


FOREST AND ORNAMENTAL TREE DISEASES

Actinopelte Leaf Spot - unlike 1982 when this disease was a problem in western Missouri, in 1983 Actinopelte leaf spot was a problem in eastern Missouri. Oak species affected included: white oak, Northern red oak, black oak, and cherry bark oak. This disease was severe during late summer, and as such should not have stressed affected trees very much.

Trend - this disease appears to be endemic in Missouri. Occasional flare-ups can be expected to occur in the future.

Suppression - raking and removing fallen leaves, and pruning branches to promote air movement, were employed to control the disease. Fertilizing affected trees was recommended to promote vigor. Ferbam, captan, and benomyl were fungicides used for control.

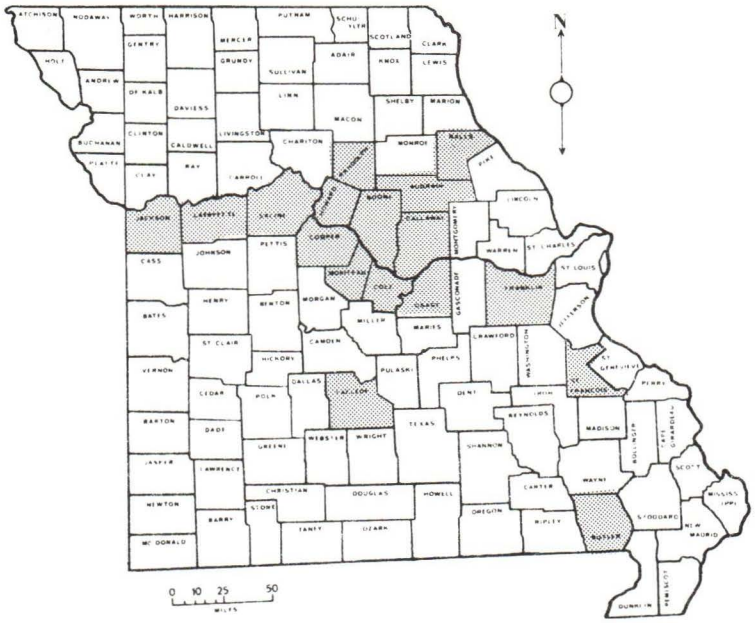


Actinopelte Leaf Spot

Apple Scab - was severe and widespread on apple and crabapple in 1983. Many trees were defoliated more than one time. Cool and wet spring weather favored disease build-up.

Trend - apple scab will periodically reach severe levels in years with abundant spring and summer moisture and cool spring temperatures.

Suppression - infected leaves were removed and destoryed. Fungicides employed in control were: benomyl, folpet, chlorothalonil and mancozeb.

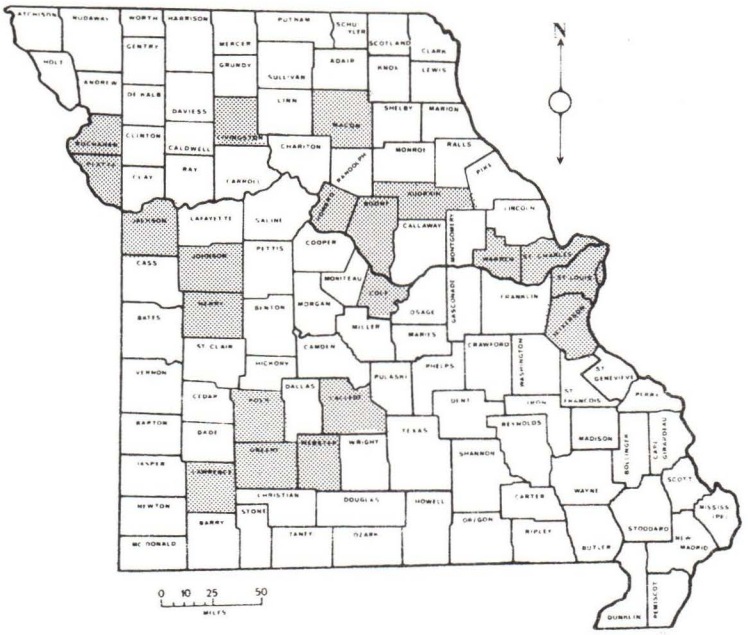


Apple Scab

Brown-Spot Needle Blight - brown-spot needle blight was widespread. The disease was only slightly to moderately damaging in Christmas tree plantations since many Christmas tree growers were actively checking and controlling for the disease.

Trend - during years with abundant spring moisture, brown-spot needle blight can be expected to be a problem of Scotch pine in Christmas tree plantations.

Suppression - control involved spraying Bordeaux mixture 8-8-100 or chlorothalonil in the spring (April-May) when new needles were half-grown and once again 3 to 4 weeks later.

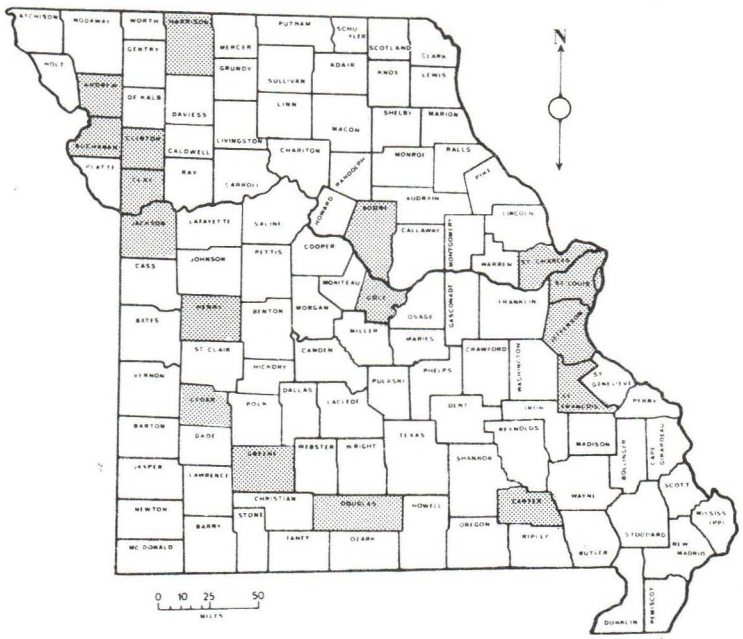


Brown Spot Needle Blight

Diplodia Tip Blight - was widespread and severe on ornamental Austrian pine more than 30 years old. Some large Scotch pine were also injured. In many cases, new infections destroyed entire tree crowns during the summer and fall of 1983.

Trend - Diplodia tip blight will continue to be a major problem of mature Austrian pine wherever it occurs in Missouri.

Suppression - good control of the disease was obtained by arborists who sprayed with Bordeaux mixture 8-8-100 at bud break (middle to end of April) and one week later.

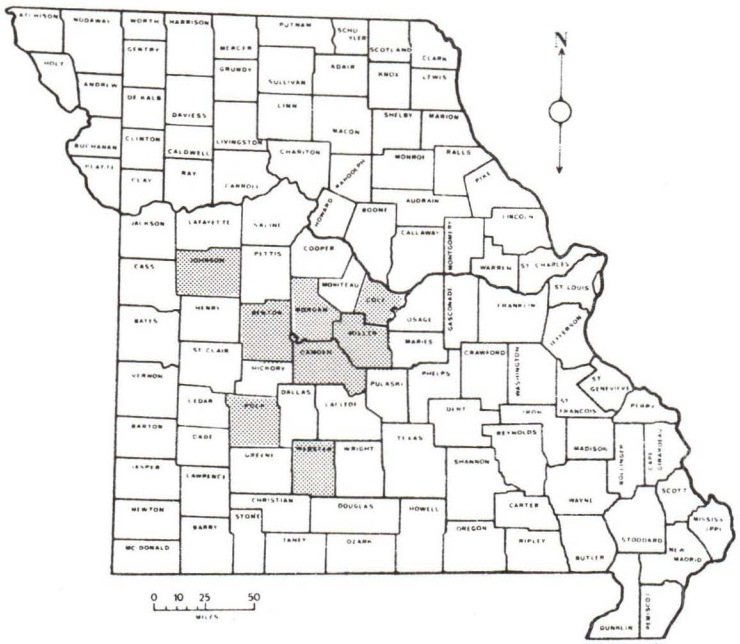


Diplodia Tip Blight

Dothistroma Needle Blight - was a problem for the first time in central Missouri. Many Austrian pine were slightly to moderately injured.

Trend - this disease may continue to spread and increase in severity.

Suppression - no control was undertaken in 1983, since the disease's occurrence was unexpected. A future control recommendation will be to spray twice with copper fungicides or chlorothalonil in mid-May and July.

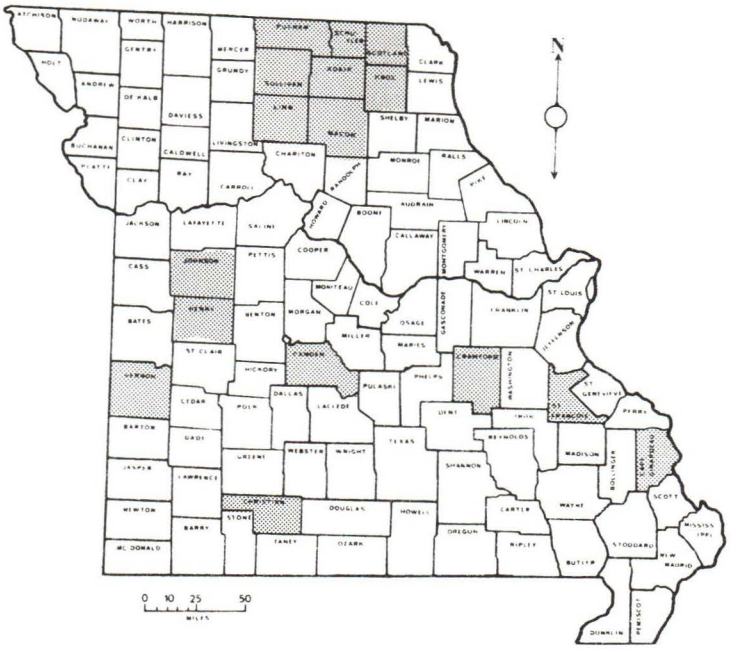


Dothistroma Needle Blight

Kabatina Blight - appeared to be a new disease in Missouri. It was widespread in occurrence and slightly to moderately damaging to Eastern red cedar and some common juniper.

Trend - this disease may continue to spread and increase in severity.

Suppression - no control measures were undertaken in 1983 as this was a new disease problem. Pruning off affected branch tips would probably aid in control. At the present time, no chemical control appears to be available for Kabatina blight.

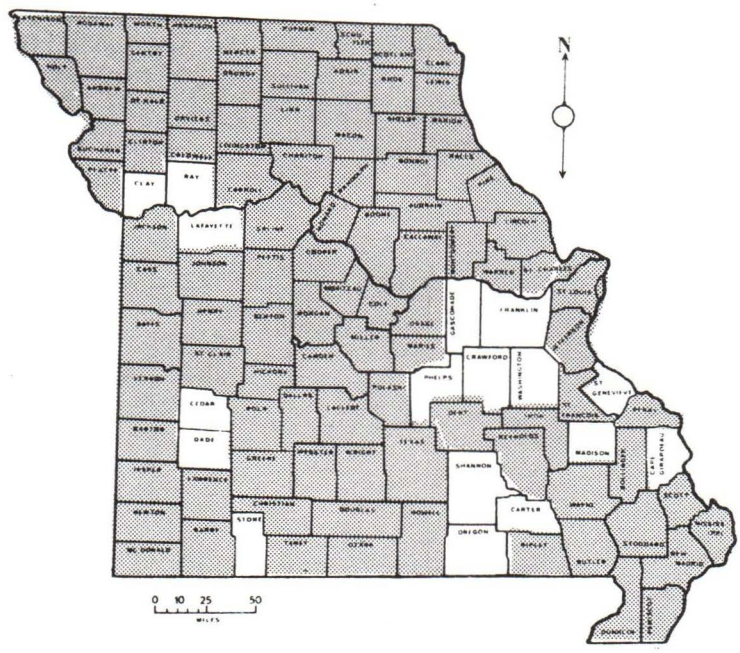


Kabatina Blight

Sycamore Anthracnose - was statewide and severely damaging to American sycamore. Most trees were completely defoliated, but refoliated about 4 weeks later (around early July).

Trend - Sycamore anthracnose will continue to be a statewide problem. Cool, wet springs will increase disease severity.

Suppression - no control measures were taken in most cases. High value ornamentals are sprayed just prior to bud break, two weeks later and a third time when new leaves have reached one-half of their mature size with protectant fungicides (Bordeaux mixture 8-8-100, Kocide, zineb, captafol, maneb).



Sycamore Anthracnose

CONCLUSION

The drought of 1983 stressed most of our trees and shrubs. This stress was more evident in heavily forested areas in south Missouri, the St. Louis area, and Kansas City area. The hot, dry conditions were conducive to spider mite development on spruce and bald-cypress.

We completed our second season with the cooperative Integrated Pest Management Program (IPM) with the University of Missouri-Columbia. This multi-state reporting program has been developed to collect and computerize pest occurrence data for most economic plant pests in the state. Forestry Division is reporting our results to the IPM program for incidence of diseases and insects on forest and ornamental trees.

Without the cooperation of our forester, we could not have collected this statewide pest incidence information.

It is always personally rewarding to work with our foresters and with the public in providing service to all who seek answers to their pest problems.

Cooperation has been our key to a successful Forest Pest Management Program.

INSECT	COUNTY
Ips (shortleaf and white pine)	Reynolds, Ripley
Loblolly Pine Sawfly (shortleaf pine)	Barry, Camden, Dallas, Howell, Iron Laclede, Oregon, Taney
Nantucket Pine Tip Moth (shortleaf and Scotch pine)	Boone, Cape Girardeau, Carter, Cass, Christian, Cole, Dent, Franklin, Greene, Howell, Iron, Laclede, McDonald, Miller, Morgan, Newton, New Madrid, Osage, Perry, Reynolds, Ripley, Shannon, Ste. Genevieve, St. Louis, Texas, Wayne, Wright
Pine Webworm (shortleaf & Scotch pine)	Franklin, Jefferson, Laclede, Perry, Ste. Genevieve
Redheaded Pine Sawfly (shortleaf pine)	Buchanan, Butler, Green, Laclede, Morgan, Ripley, Taney
Scales (oak)	Bollinger, Boone, Butler, Clay, Greene, Howard, Jackson, Jefferson, Marion, Platte, St. Charles, St. Louis, St. Louis City, Warren
Shingle Oak Skeletonizer (shingle oak)	Andrew, Benton, Boone, Buchanan, Cass, Christian, Clay, Clinton, Cole, Cooper, Dent, Greene, Harrison, Henry, Jackson, Johnson, Lafayette, Maries, Morgan, Pettis, Phelps, Ray, Saline
Tree Grasshopper (oak)	Iron, Reynolds
Walking Stick (oak)	Linn
Bagworms (Eastern red cedar)	Barry, Barton, Bates, Benton, Boone, Cape Girardeau, Camden, Cass, Christian, Clark, Cole, Crawford, Dent, Iron, Jackson, Jasper, Johnson, Lafayette, Laclede, Lawrence, Lewis, Lincoln, Marion, McDonald, Morgan, Perry, Pettis, Phelps, Pike, Ralls, Reynolds, Shelby, St. Clair, St. Francois, St. Louis, Taney, Vernon
Black Turpentine Beetle (shortleaf pine)	Iron, Texas, Wayne
Borers (oak)	Adair, Boone, Buchanan, Butler, Clay, Cole, Daviess, Franklin, Gasconade, Greene, Harrison, Howard, Iron, Jackson, Jefferson, Laclede, Livingston, Madison, Morgan, New Madrid, Phelps, Shannon, St. Francois, Ste. Genevieve, Washington, Wayne

INSECT	COUNTY
Bronze Birch Borer (white birch)	Boone, Buchanan, Cole
Eastern Tent Caterpillar (black cherry)	Barry, Butler, Jasper, Jefferson, Newton, McDonald, Perry, Reynolds, Ripley, St. Charles, St. Louis City, St. Louis
Elm Leaf Beetle (elm)	Statewide
European Pine Sawfly (Scotch pine)	Buchanan, Butler, Clay, Jackson, Lafayette, Monroe, Phelps, St.Clair, St. Louis City, St. Louis County
Fall Webworm (hickory, walnut, red bud, sycamore)	Barry, Barton, Bates, Benton, Bollinger, Buchanan, Camden, Cape Girardeau, Carter, Cass, Cedar, Christian, Cole, Cooper, Crawford, Dade, Dallas, Douglas, Dunklin, Greene, Henry, Hickory, Jackson, Jasper, Jefferson, Johnson, Laclede, Lawrence, Madison, McDonald, Miller, Moniteau, Newton, Ozark, Perry, Pettis, Platte, Polk, Reynolds, Ripley, Shannon, Stone, St. Clair, St. Francois, Ste. Genevieve, St. Louis, Stoddard, Sullivan, Taney, Texas, Vernon, Wayne, Webster
Gall Insects (oak, hackberry)	Audrain, Barry, Benton, Chariton, Dallas, Jackson, Jasper, Jefferson, Laclede, Pettis, Platte, Polk, Reynolds, St. Charles, St. Louis City, St. Louis County, Texas, Washington

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PEST & HOST	COUNTY
Actinopelte Leaf Spot (cherry bark oak, white oak, pine oak, Northern red oak, black oak)	Reynolds, St. Louis, Dunklin
Apple Scab (crabapple, apple)	St. Francois, Laclede, Osage, Cole, Saline, Howard, Randolph, Boone, Audrain, Callaway, Moniteau, Cooper, Jackson, Butler, Ralls, Franklin, Lafayette.
Ash Anthracnose (green ash, white ash)	Greene, Christian, Taney, Vernon, Webster, Jefferson, St. Charles, St. Louis City, St. Louis County, Harrison

Ash Decline (Green ash, white ash)	Jefferson, St. Charles, St. Louis, St. Louis City, Carter, DeKalb, Andrew
Armillaria Root Rot (black oak)	Miller
Bacterial Wetwood of Elm (American elm, Siberian elm)	Reynolds, Henry, Butler, Boone, Jefferson, St. Charles, St. Louis, St. Louis City, Audrain, Cass, Laclede, Camden, Henry
Black Knot of Plum and Cherry (black cherry)	Wayne, Texas
Bleeding Canker (red maple, sweetgum, English oak, white oak)	Camden, Boone, Laclede, St. Louis, Newton, Jasper, DeKalb, Dunklin
Botryodiplodia Canker (black oak, pin oak)	St. Louis, Scott
Botrytis Blight (flowering dogwood)	Jackson, St. Louis
Brown-Spot Needle Blight (Scotch pine)	Jackson, Henry, Livingston, Greene, Webster, Macon, Buchanan, Laclede, Johnson, Boone, Audrain, Polk, Platte, Jefferson, St. Charles, St. Louis, St. Louis City, Lawrence, Warren, Cole, Howard
Butternut Decline (butternut)	Reynolds, Shannon
Cedar-Apple Rust (apple, crabapple)	Dent, Osage, Franklin, Boone, Callaway, Henry, Laclede, Butler, Jackson, Franklin, Crawford, Livingston
Cedar-Apple Rust (E. red cedar, ornamental junipers)	Marion, St. Charles, St. Louis, St. Louis City, Greene, Johnson, Jefferson, Laclede, Dallas, Hickory, Douglas, Jackson, Wayne, Pulaski, Phelps, Bollinger, Cape Girardeau, Madison, Ste. Genevieve, St. Francois, Butler, Adair, Buchanan, Boone, Monroe, Howell, Douglas, Ozark, Texas, Wright, Maries, Osage, Henry, Reynolds, Perry, Gasconade, Clay, Webster
Cedar-Hawthorn Rust (hawthorn)	Boone, Callaway, Texas, Henry, Jackson
Coryneum Twig Blight of Oak (black oak, white oak, post oak)	Callaway, Grundy, St. Louis
Cytospora Canker of Willow (weeping willow)	Laclede, Taney

Cytospora Canker of Blue Spruce (Colorado blue spruce)	St. Louis
Diplodia Tip Blight (Scotch pine, Austrian pine)	Henry, Greene, Buchanan, Jackson, St. Louis City, Jefferson, St. Charles, St. Louis, Harrison, Douglas, Cole, Clinton, Andrew, Boone, Clay, St. Francois, Cedar, Carter
Dothistroma Needle Blight (Austrian pine, Ponderosa pine)	Camden, Webster, Polk, Johnson, Cole, Benton, Miller, Morgan
Drought Damage (post oak, scarlet oak, black oak, pin oak, Northern red oak, arborvitae, cherry, hickory, pecan, Scotch pine, E. white pine, red bud, hackberry, black walnut)	Jefferson, Douglas, Ozark, Crawford, St. Charles, St. Louis, St. Louis City, Morgan, Christian, Polk, Greene, Taney, Stone, Bollinger, Cape Girardeau, Jefferson, Madison, Perry, Ste. Genevieve, St. Francois, Franklin, Gasconade, Osage, Maries, Phelps, Camden, Vernon, Platte, Clay, Jackson, Ray, Lafayette, Iron, Reynolds, Carter, Butler, Texas, Howell, Douglas, Barry, Barton, Jasper, Lawrence, McDonald, Newton, Ripley, Stoddard, Scott, Putnam, Buchanan, Cole, Shannon, Oregon, Carter, Knox, Stone, Adair, Macon, Scotland, Sullivan, Linn, Schuyler, Dunklin, Pemiscot, New Madrid, Mississippi
Dutch Elm Disease (American elm, hybrid elm)	Texas, Cedar, Carter, Iron, Reynolds, Wayne, Phelps, Laclede, Jefferson, St. Louis, St. Louis City, St. Francois, Ste. Genevieve, Madison, Perry, Bollinger, Cape Girardeau, Clark, Lewis, Shelby, Marion, Monroe, Ralls, Pike, Lincoln, Montgomery, Warren, Butler, Lafayette, Platte, Dent, Boone, Buchanan, Atchison, Holt, Andrew, Nodaway, Worth, Gentry, Daviess, DeKalb, Harrison, Clinton, Chariton, Caldwell, Mercer, Grundy, Carroll, Livingston, Clay, Jackson, Greene, Boone, Oregon
Eastern Gall Rust (shortleaf pine)	Reynolds, Crawford, Greene
Elm Phloem Necrosis (American elm, rock elm)	Buchanan, Henry, Texas, Iron, Reynolds, Wayne, Adair, Jefferson, St. Charles, St. Louis, St. Louis City, Livingston
Fireblight (rose, hawthorn, apple, pear, crabapple)	Wayne, Adair, Linn, Buchanan, Butler, Iron, Reynolds, Laclede, Boone, Butler, Cole, St. Louis, Texas, Jackson
Fusarium Canker of Walnut (black walnut)	Nodaway, Andrew, Stoddard

Heat Scorch (sugar maple, hickory, linden, red bud, birch, cottonwood, ash, sweetgum, dogwood, hackberry, shingle oak, Northern red oak, white oak, black oak, many other species)	Phelps, Perry, Callaway, Chariton, Jefferson, St. Charles, St. Louis, St. Louis City, Iron, Reynolds, Cass, Bates, Vernon, Johnson, Henry, St. Clair, Pettis, Benton, Buchanan, Livingston, Crawford, Maries, Osage, Clay, Jackson, Lafayette, Platte, Greene, Saline, Franklin, Howard, Randolph, Boone, Audrain, Callaway, Moniteau, Cole, Cooper
Hypoxylon Canker of Oak (post oak, white oak, Northern red oak, black oak, scarlet oak)	Barry, Lawrence, McDonald, Newton, Reynolds, Camden, St. Louis
Kabatina Blight (Eastern red cedar, common juniper)	Camden, Crawford, Johnson, Christian, Vernon, St. Francois, Putnam, Sullivan, Linn, Schuyler, Adair, Macon, Scotland, Knox, Cape Girardeau, Henry
Maple Anthracnose (Norway maple, silver maple, sugar maple)	Butler, Wright, Texas, Douglas, Howell, Ozark, Livingston, Camden, Miller, Morgan, Henry, Jefferson, St. Charles, St. Louis, St. Louis City, Newton, Camden, Henry, Scott
Maple Canker (sugar maple)	Marion, Cole
Maple Decline (sugar maple, Norway maple, red maple)	Buchanan, Stoddard, Marion, Jackson, Wayne, Boone, Douglas, Laclede, Phelps, Jefferson, St. Charles, St. Louis, St. Louis City, Andrew, Greene
Mimosa wilt (mimosa)	Butler, Ripley
Monochaetia Leaf Spot (white oak)	Reynolds
Naemacyclus Needlecast (Scotch pine)	Livingston, Cole, Marion, Johnson, Cass, Warren, Phelps, Osage, Boone, Maries
Nectria Target Canker (post oak)	Reynolds
Needle Tip Burn (Eastern white pine)	St. Louis, Jackson
Oak Anthracnose (Northern red oak, white oak, pin oak, black oak)	Shannon, Camden, Miller, Morgan, Pike, Buchanan, Iron, Reynolds, Camden
Oak Leaf Blister (Northern red oak, white oak, black oak)	Jefferson, St. Charles, St. Louis, St. Louis City, Reynolds, Wayne, Camden, Lincoln, Iron
Oak Wilt (Northern red oak, black oak, pin oak, white oak, scarlet oak, shingle oak)	Clark, Lewis, Shelby, Marion, Monroe, Ralls, Pike, Lincoln, Warren, Montgomery, Platte, Jackson, Buchanan, Boone, Reynolds, Henry, St. Louis, Cape Girardeau, Camden, Iron, Pettis
Pestalotia Blight (Scotch pine)	Warren

Phomopsis Blight (Eastern red cedar, ornamental junipers)	Henry, Boone, Jefferson, St. Charles, St. Louis, St. Louis City, Jackson, Iron, Wayne, Buchanan, Harrison, Reynolds, Phelps, Greene, Camden, Butler, Cole
Pine Needle Rust (shortleaf pine)	McDonald, Oregon, Morgan, Ste. Genevieve
Pine Wilt Disease (Scotch pine)	Camden, Franklin, Boone, Jefferson, St. Charles, St. Louis, St. Louis City
Rhizosphaera Needlecast (Colorado blue spruce)	Livingston, Jackson, Laclede, Buchanan, Harrison, Osage, Newton, Greene, Henry, Iron, St. Louis,Callaway
Sapsucker Injury (maple, sweetgum, apple, black walnut, hickory, white birch, chinkapin oak, Scotch pine, Austrian pine, Eastern white pine)	Clay, Jackson, Franklin, Buchanan, Greene, Butler, Camden, Jefferson, Webster, Boone, Reynolds, Henry, St. Charles, St. Louis, St. Louis City, Camden, Marion, Iron, Laclede, Christian, Stone, Taney, Dallas, Benton, Newton, Gasconade, Carter, Cole
Squirrel Injury (pin oak, hackberry)	Jackson, Buchanan
Sycamore Anthracnose (American sycamore)	Newton, Ozark, Iron, St. Clair, Henry, Douglas, Howell, Morgan, Camden, Clinton, Livingston, Texas, Wright, Jefferson, Cole, St. Charles, St. Louis, Jackson, St. Louis City, Boone, Clark, Lewis, Shelby, Marion, Monroe, Ralls, Pike, Lincoln, Montgomery, Warren, Audrain, Callaway, Cooper, Howard, Moniteau, Randolph, Saline, Putnam, Sullivan, Linn, Schuyler, Adair, Macon, Scotland, Knox, Barry, Barton, Bollinger, McDonald, Holt, Buchanan, Atchison, Andrew, Nodaway, Worth, Gentry, Daviess, DeKalb, Harrison, Chariton, Platte, Caldwell, Mercer, Grundy, Carroll, Polk, Greene, Dallas, Laclede, Christian, Webster, Miller, Hickory, Taney, Vernon, Wayne, St. Francois, Perry, Reynolds, Cass, Bates, Johnson, Pettis, Benton, Butler, Stoddard, Scott, Pemiscot, Mississippi, New Madrid, Dunklin, Ripley, Dent, Maries, Osage, Pulaski, Jasper, Lawrence
Tar Spot (Sugar maple)	Maries
Thyronectria Canker (sunburst honeylocust)	Reynolds
Verticillium Wilt (ash, Norway, maple, sugar maple, Northern red oak, green ash)	DeKalb, Boone, Franklin, Jackson, Harrison, St. Louis, Warren, Montgomery, Platte, Buchanan, Carter, Phelps, Livingston, Boone
Walnut Anthracnose (black walnut)	Holt, Buchanan

Winter Drying and Winter Burn (Scotch pine, Austrian pine, Eastern white pine, arborvitae)	St. Louis, Camden

Forest Pest Management
Missouri Department of Conservation
P.O. Box 180
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